Modulhandbuch

Master of Science im Fach Sustainable Materials
(Prüfungsordnungsversion 2017)

Inhaltsverzeichnis

Prolog

The study program Master of Science Sustainable Materials – Polymer Science is a binational, consecutive, research-oriented four-semester study course. It is taught alternatively the University of Freiburg and at the University of Strasbourg and leads to a double degree.
In the profile line Polymer Sciences- bilingual, the focus is put on selected material and polymer science topics, which provide a sound introduction to the various other areas of the physical and chemical properties of materials as well as the technologies and the application of polymers. Students can choose to deepen their knowledge in the material science, biology science, environmental science and engineering science.
You will find below the list of courses at Freiburg University from the 2nd to 4th semester.

The Master study course is divided in 4 parts:

First semester in Strasbourg University (see module handbook of Strasbourg University)

Second semester in Freiburg University:
Lab course “Macromolecular Materials and Chemistry”.
Prior to the Lab course, the lab entrance examination is taken. This exam must be passed in order to be allowed to attend the lab course and subsequently choose a major module. (more details see the module description "Lab Course Macromolecular Materials and Chemistry")
Major modules

- Advanced Macromolecular Materials and Nanostructure Engineering,
- Macromolecular Engineering and System Integration,
- Biomaterials and Biosystems
- Biobased and Bioinspired Materials

In addition to the subject-specific courses, the following mandatory classes must be taken:
language courses in German in the second semester as well as in the third semester if the third semester is spent in Freiburg
intercultural seminars to reinforce the intercultural competence.
They are followed during the first and second semester..
Furthermore, an introduction seminar is held at the beginning of the semester focusing on academic practice, study techniques and communication in a German University.

Third semester: free choice between all options offered in Strasbourg or in Freiburg for this semester

alltogether: 30 ECTS-Points

variant 1	variant 2	variant 3	variant 4
Lecture 6-12 ECTS	Advanced Practical Lab 18 ECTS	Advanced Practical Lab 12 ECTS	Lecture 12 ECTS
Advanced Practical Lab 6-12 ECTS		Methods and concepts 6 ECTS	Methods and concepts 6 ECTS
Language Course 3 ECTS	Language Course 3 ECTS	Language Course 3 ECTS	Language Course 3 ECTS
Industrial Polymer Science 9 ECTS	Industrial Polymer Science 9 ECTS	Industrial Polymer Science 9 ECTS	Industrial Polymer Science 9 ECTS

Fourth semester: Master thesis

The Master thesis may be completed at the University of Freiburg or at the University of Strasbourg

Modulname	**Nummer**
Lab Course Macromolecular Materials and Chemistry	08LE05MO-88633086-100
Modulverantwortliche/r	
Prof. Dr. Andreas Walther	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	9.0
Empfohlenes Fachsemester	1
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	360 h

Teilnahmevoraussetzung
Previous attendance to the Introduction Course, which is not graded but necessary to take up the lab course Macromolecular Materials and Chemistry. The theoretical Colloquium has to be passed to start the practical lab.

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Lab Course Macromolecular Materials and Chemistry - Polymer Sciences	Lehrveranstaltung	Pflicht		8.00	
Introduction	Seminar	Pflicht		1.00	

Qualifikationsziel
The Lab Course Macromolecular Materials and Chemistry builds on the basics of macromolecular chemistry, polymer physics and polymer technologies. It provides knowledge and skills deepening in polymers sciences. Students learn to use methods for synthesis, for material characterizing, for functional polymers design and for polymers processing.
Zu erbringende Prüfungsleistung
PL: report of experiments (25%); colloquium (25%); final presentation (25%); lab working (25%)

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Modulname	**Nummer**
Lab Course Macromolecular Materials and Chemistry	08LE05MO-88633086-100
Veranstaltung	
Lab Course Macromolecular Materials and Chemistry - Polymer Sciences	
Veranstaltungsart	Nummer
Lehrveranstaltung	08LE05P-ID050314
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie-VB	

ECTS-Punkte	
Semesterwochenstunden (SWS)	8.0
Empfohlenes Fachsemester	1
Angebotsfrequenz	nur im Wintersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
First two weeks: in the afternoon safety briefing and Lab Safety under the supervision of tutors. Third week: Seminar basic overview on the teachers' research and working groups involved in this master program. 2 Days: (optional?) Participation in the Macromolecular Colloquium in Freiburg Two weeks, whole day practical experiences in lab using methods in polymer sciences, controlled method of polymerization, polymer analytics (GPC, MALDI-TOF, NMR), modern microscopy on surfaces and interfaces (AFM, TEM, ESEM), rheology und polymerization, polymer materials (Duroplaste, Thermoplaste, Kautschuk), dispersion, biopolymer and polymer for Life Sciences.
Zu erbringende Prüfungsleistung
see module "Lab Course Macromolecular Materials and Chemistry"
Zu erbringende Studienleistung
Zwingende Voraussetzung
"Precolloqium" has to be passed before starting the Lab Course.

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Modulname	**Nummer**
Lab Course Macromolecular Materials and Chemistry	08LE05MO-88633086-100
Veranstaltung	
Introduction	
Veranstaltungsart	Nummer
Seminar	08LE05S-88633086-100
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	1.0
Empfohlenes Fachsemester	1
Angebotsfrequenz	nur im Wintersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
Course contents are: • typical study techniques (i.e. protocol, oral presentations, taking notes, writing term papers) • communication with lecturers and professors • typical teaching methods at German universities • introduction to German academic higher education and learning culture • general intercultural awareness
Zu erbringende Prüfungsleistung
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Zu erbringende Studienleistung
attendance is obligatory
Zwingende Voraussetzung
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Name des Kontos	Nummer des Kontos
Major module	08LE05KO-88633-2017_400
Verantwortliche/r	
Prof. Dr. Andreas Walther	
Fachbereich / Fakultät	

Pflicht/Wahlpflicht (P/WP)	Pflicht
ECTS-Punkte	15,0
Benotung	A- Berechnung 1 NachK
Empfohlenes Fachsemester	2

Kommentar
The students has to chose between the main focus aereas: ■ Advanced Macromolecular Materials and Nanostructure Engineering: Advanced knowledge of designing, structuring and implementing advanced functional polymers. ■ Macromolecular Engineering and System Integration: Advanced knowledge of surface analysis, (micro) fabrication and assembly of flexible, energy-autonomous embedded micro systems and their applications. ■ Biomaterials and Biosystems: Advanced knowledge of biobased polymer materials for sustainable development, exploiting renewable resources and the integration of biopolymer and synthetic functional polymers into systems. The master thesis could be in another focus area than the major module. ■ Biobased Materials: Advanced knowledge of biobased polymer materials for sustainable development, exploiting renewable resources and the integration of biopolymer and synthetic functional polymers into (bio/micro) systems. The master thesis could be in another focus area than the major module.

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Modulname	**Nummer**
Major module: Advanced Macromolecular Materials and Nanostructure Engineering	08LE05MO-88633086_2017-401
Modulverantwortliche/r	
Prof. Dr. Andreas Walther	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	15.0
Empfohlenes Fachsemester	2
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	450h

Teilnahmevoraussetzung
For Bilingual profile: M1 “Macromolecular Materials and Chemistry” or M2 “Polymer Physics” (one of them) and the lab course in “Macromolecular Materials and Chemistry” have to be passed. For Binational profile: lab course in “Macromolecular Materials and Chemistry” have to be passed.

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Physical Processes of Self-Assembly and Pattern Formation	Vorlesung	Pflicht		3.00	
Physical Processes of Self-Assembly and Pattern Formation - Tutorial	Übung	Pflicht		2.00	
Functional polymers for sustainable development	Vorlesung	Pflicht		2.00	
MC V Soft Matter and Bio Nanosciences	Vorlesung	Pflicht		2.00	
Basic principles of polymer technology	Vorlesung	Pflicht		1.00	

Qualifikationsziel
This module will provide systematic knowledge about conventional and advanced processing technologies of polymer materials. The objective is to understand the entire process chain starting from the selection of the polymer material, the involved processing to the final component in view of the desired properties.
Zu erbringende Prüfungsleistung
PL - Oral exam on the content of lectures "Physical Processes of Self-Assembly and Pattern Formation", "Functional polymers for sustainable development", "MC V Soft matter and Bio Nanoscience" and "Basic principles of polymer technology".

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Modulname	**Nummer**
Major module: Advanced Macromolecular Materials and Nanostructure Engineering	08LE05MO-88633086_2017-401
Veranstaltung	
Physical Processes of Self-Assembly and Pattern Formation	
Veranstaltungsart	Nummer
Vorlesung	07LE33V-SELFAS
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie Physikalisches Institut-VB	

ECTS-Punkte	
Semesterwochenstunden (SWS)	3.0
Empfohlenes Fachsemester	
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
Zu erbringende Prüfungsleistung
Zu erbringende Studienleistung
Zwingende Voraussetzung

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Modulname	**Nummer**
Major module: Advanced Macromolecular Materials and Nanostructure Engineering	08LE05MO-88633086_2017-401
Veranstaltung	
Physical Processes of Self-Assembly and Pattern Formation - Tutorial	
Veranstaltungsart	Nummer
Übung	07LE33Ü-SELFAS
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie Physikalisches Institut-VB	

ECTS-Punkte	
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
Zu erbringende Prüfungsleistung
Zu erbringende Studienleistung
Zwingende Voraussetzung

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Modulname	**Nummer**
Major module: Advanced Macromolecular Materials and Nanostructure Engineering	08LE05MO-88633086_2017-401
Veranstaltung	
Functional polymers for sustainable development	
Veranstaltungsart	Nummer
Vorlesung	08LE05V-ID050029
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
In this course, the ecological aspects of polymers and their key role in sustainable development and the prospects of green economy will be learned. An important objective is to understand how polymers contribute to high resource-, cost- and energy-effectiveness and modern high technologies, meeting the demands of a growing world population. Special focus is placed upon polymer waste recycling, bio-based polymers, renewable resources, polymers with low carbon footprint, and tailored polymers for application in energy-related new technologies.
Zu erbringende Prüfungsleistung
Part of the Exam "Advanced Macromolcular Materials and Nanostructural Engineering" of the study program M.Sc. Sustainable Materials - Polymer Science.
Zu erbringende Studienleistung
for methods and concepts: 1 ECTS attendance
Zwingende Voraussetzung
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Modulname	**Nummer**
Major module: Advanced Macromolecular Materials and Nanostructure Engineering	08LE05MO-88633086_2017-401
Veranstaltung	
MC V Soft Matter and Bio Nanosciences	
Veranstaltungsart	Nummer
Vorlesung	08LE05V-ID050427
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie-VB	

ECTS-Punkte	
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	deutsch

Inhalte
This course will connect self-assembly and other structuration processes to the materials world with a special emphasis on soft matter and biobased/biological components: Self-assembly vs. self-organization; switches vs. motors; responsive vs active materials; hierarchical force and time scales; surface forces and wetting; liquid crystalline polymers; reversible polymers and self-healing; biobased macromolecular systems (peptide, proteins, DNA Nanoscicence); topology effects of macromolecular systems.
Zu erbringende Prüfungsleistung
Im Rahmen der Modulteilprüfung Makromolekulare Chemie im Studiengang M.Sc. Chemie können 3 ECTS Punkte angerechnet werden. In diesem Fall werden keine weiteren ECTS Punkte als Studienleistung im Modul „Methoden und Konzepte“ angerechnet. Part of the Exam "Advanced Macromolcular Materials and Nanostructural Engineering" of the study program M.Sc. Sustainable Materials - Polymer Science.
Zu erbringende Studienleistung
for methods and concepts: 1 ECTS attendance
Zwingende Voraussetzung
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Modulname	**Nummer**
Major module: Advanced Macromolecular Materials and Nanostructure Engineering	08LE05MO-88633086_2017-401
Veranstaltung	
Basic principles of polymer technology	
Veranstaltungsart	Nummer
Vorlesung	08LE05V-ID050030
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	1.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
In this course, the basic principles and methods of polymer processing, used for tailoring of advanced multi-component and multiphase polymeric materials, will be learned. An important objective is to understand how polymers are rendered processable and how macromolecules are converted into useful materials for applications ranging from moldings to rubbers, fibers, blends, composites and formulated products such as coatings, adhesives and sealants.
Zu erbringende Prüfungsleistung
Part of the oral Exam of the module "Advanced Macromolcular Materials and Nanostructural Engineering" or " "Macromolecular Engineerin and System Integration" in the study program M.Sc. Sustainable Materials - Polymer Science.
Zu erbringende Studienleistung
for methods and concepts: 1 ECTS attendance
Zwingende Voraussetzung
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Modulname	**Nummer**
Major module: Macromolecular Engineering and System Integration	08LE05MO-88633086_2017-402
Modulverantwortliche/r	
Prof. Dr. Jürgen Rühe	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	15.0
Empfohlenes Fachsemester	2
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	450h

Teilnahmevoraussetzung
For Bilingual profile: M1 “Macromolecular Materials and Chemistry” or M2 “Polymer Physics” (one of them) and the lab course in “Macromolecular Materials and Chemistry” have to be passed. For Binational profile: lab course in “Macromolecular Materials and Chemistry” have to be passed.

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Oberflächenanalyse / Surface Analysis - Vorlesung	Vorlesung	Pflicht	3.0	2.00	90 Stunden
Oberflächenanalyse – Praktikum / Surface Analysis Laboratory	Praktikum	Pflicht	3.0	2.00	
Basic principles of polymer technology	Vorlesung	Pflicht		1.00	
Grenzflächen für bioanalytische Systeme / Interfaces for Bioanalytical Systems - Vorlesung	Vorlesung	Pflicht	3.0	2.00	90 Stunden
Von Mikrosystemen zur Nanowelt / From Microsystems to the Nanoworld - Vorlesung	Vorlesung	Pflicht	3.0	2.00	90 Stunden
Polymer Processing and Microsystems Engineering - Vorlesung	Vorlesung	Pflicht		2.00	

Qualifikationsziel
The objective of this module is to provide detailed knowledge about the processing and properties of reinforced polymer materials. The lecture will cover various concepts to polymeric matrices. The students will also obtain an overview about relevant technical applications of these advanced engineering polymers. In addition the laboratorycourse will expend their knowledge in polymer surfaces.
Zu erbringende Prüfungsleistung
PL: written exam on the contents of courses. compensation is possible

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Modulname	**Nummer**
Major module: Macromolecular Engineering and System Integration	08LE05MO-88633086_2017-402
Veranstaltung	
Oberflächenanalyse / Surface Analysis - Vorlesung	
Veranstaltungsart	Nummer
Vorlesung	11LE50V-5606-1
Veranstalter	
Institut für Mikrosystemtechnik, Chemie und Physik von Grenzflächen	
Fachbereich / Fakultät	
Institut für Mikrosystemtechnik Technische Fakultät	

ECTS-Punkte	3.0
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch
Workload	90 Stunden

Inhalte
The techniques presented are grouped into three general topics which are imaging of surfaces (electron microscopy, scanning probe techniques), chemical analysis (XPS, SIMS, FTIR) of the composition of surfaces and methods for the determination of thicknesses (Ellipsometry, XRR, Surface Plasmon Spectroscopy) of layers. General topics from the surface sciences such as adhesion, wetting, and adsorption processes are also presented together with the techniques.
Zu erbringende Prüfungsleistung
Schriftliche oder mündliche Abschlussprüfung
Zu erbringende Studienleistung
Literatur
Various materials are available on the website.
Zwingende Voraussetzung

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Modulname	**Nummer**
Major module: Macromolecular Engineering and System Integration	08LE05MO-88633086_2017-402
Veranstaltung	
Oberflächenanalyse – Praktikum / Surface Analysis Laboratory	
Veranstaltungsart	Nummer
Praktikum	11LE50P-5311
Fachbereich / Fakultät	
Institut für Mikrosystemtechnik, Chemie und Physik von Grenzflächen Technische Fakultät	

ECTS-Punkte	3.0
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
Topic 1: **Determination of the layer thickness and roughness of biocompatible coatings** Experiment 1: Using ellipsometry and x-ray reflectometry to determine the thickness of hydrogel coatings Topic 2: **Wetting of surfaces – Surface free energies** Experiment 2: Measurement of the contact angles of test liquids in various surfaces; Determination of the surface free energy using the Zisman method Experiment 3: Generation and characterization of microarrays on various surfaces Topic 3: **Proteins / peptides on surfaces** Experiment 4: Measurement of the adsorption of blood proteins on surfaces using Surface Plasmon Resonance Experiment 5: Characterization of the structure of protein layers using Fourier Transform Infrared Spectroscopy Topic 4: **DNA at surfaces** Experiment 6: Visualisation of DNA on mica using the Atomic Force Microscope
Zu erbringende Prüfungsleistung
Before each experiment there will be an oral examination and for each experiment the student has to submit a written laboratory report. Die Modulnote errechnet sich aus dem arithmetischen Mittel der mündlichen Prüfungen und der Praktikumsberichte.
Zu erbringende Studienleistung
Literatur
Script
Zwingende Voraussetzung

Bemerkung / Empfehlung
Findet am Lehrstuhl statt

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Modulname	**Nummer**
Major module: Macromolecular Engineering and System Integration	08LE05MO-88633086_2017-402
Veranstaltung	
Basic principles of polymer technology	
Veranstaltungsart	Nummer
Vorlesung	08LE05V-ID050030
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	1.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
In this course, the basic principles and methods of polymer processing, used for tailoring of advanced multi-component and multiphase polymeric materials, will be learned. An important objective is to understand how polymers are rendered processable and how macromolecules are converted into useful materials for applications ranging from moldings to rubbers, fibers, blends, composites and formulated products such as coatings, adhesives and sealants.
Zu erbringende Prüfungsleistung
Part of the oral Exam of the module "Advanced Macromolcular Materials and Nanostructural Engineering" or " "Macromolecular Engineerin and System Integration" in the study program M.Sc. Sustainable Materials - Polymer Science.
Zu erbringende Studienleistung
for methods and concepts: 1 ECTS attendance
Zwingende Voraussetzung
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Modulname	**Nummer**
Major module: Macromolecular Engineering and System Integration	08LE05MO-88633086_2017-402
Veranstaltung	
Grenzflächen für bioanalytische Systeme / Interfaces for Bioanalytical Systems - Vorlesung	
Veranstaltungsart	Nummer
Vorlesung	11LE50V-5407
Veranstalter	
Institut für Mikrosystemtechnik, Chemie und Physik von Grenzflächen	
Fachbereich / Fakultät	
Technische Fakultät	

ECTS-Punkte	3.0
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch
Workload	90 Stunden

Inhalte
■ Wechselwirkung von Oberflächen mit biologischen Umgebungen ■ Designkriterien für bioanalytische Oberflächen und Grenzflächen ■ Methoden und Techniken der Biochipherstellung ■ Biochips für die Analytik von Nukleinsäuren ■ Protein Biochips ■ Komplexe Biochiptechniken
Zu erbringende Prüfungsleistung
Written or oral examination
Zu erbringende Studienleistung
Literatur
Materialien werden über das ILIAS-System bereitgestellt. Eine ILIAS-Seite wird vor Vorlesungsbeginn erstellt und den Studierenden zugänglich gemacht.
Zwingende Voraussetzung

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Modulname	**Nummer**
Major module: Macromolecular Engineering and System Integration	08LE05MO-88633086_2017-402
Veranstaltung	
Von Mikrosystemen zur Nanowelt / From Microsystems to the Nanoworld - Vorlesung	
Veranstaltungsart	Nummer
Vorlesung	11LE50V-5101
Fachbereich / Fakultät	
Institut für Mikrosystemtechnik Technische Fakultät	

ECTS-Punkte	3.0
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	3
Angebotsfrequenz	nur im Wintersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch
Workload	90 Stunden

Inhalte
1. INTRODUCTION What is nanotechnology? The long way of science to nanotechnology and nanoengineering: a survey. The current aspects of nanoengineering: beyond terabyte hard drives. Future aspects: Molecular motors and engines. Nano robots and nano machinery. 2. FOUNDATIONS The physics governing properties of objects on the micro- and nano-scale. Principles of manufacturing nanometer scale devices: Nature's strategy: biomotors based on proteins - something the human body already does, top-down approach: miniaturization of macro-world principles to ever smaller scales, bot-tom-up strategy: from synthesizing simple compounds consisting of a few atoms to nanoengines. Examples of man-made nanostructures. Properties of novel materials, Strategies for visualization and object handling in the nano world. 3. PROBLEMS From Micro to Nano: what's different. Physical and societal limits of nano engineering.
Zu erbringende Prüfungsleistung
Schriftliche oder mündliche Abschlussprüfung
Zu erbringende Studienleistung
Zwingende Voraussetzung

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Modulname	**Nummer**
Major module: Macromolecular Engineering and System Integration	08LE05MO-88633086_2017-402
Veranstaltung	
Polymer Processing and Microsystems Engineering - Vorlesung	
Veranstaltungsart	Nummer
Vorlesung	11LE50V-5124
Fachbereich / Fakultät	
Technische Fakultät	

ECTS-Punkte	
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	3
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch
Präsenzstudium	28 Stunden

Inhalte
This lecture series describes basic principles of polymer processing and special applications in micro-systems engineering. Here, the topics will be various variants of Hot Embossing, Nanoimprint Lithography, Micro Injection Molding and Fused Deposition Modeling and Micro Injection Molding as well as techniques for the generation of coatings (e.g. doctor blading, spray coating). Further topics are centered around microstructure generation in reactive systems using techniques such as Stereolithography, Reaction Molding and Inkjet Techniques. These experimental/technological aspects will be accompanied by theoretical methods for their description which will focus on fluid dynamics, dynamic behavior during molding (shear thinning, yield stress and segregation) and the simulation of these processes.
Zu erbringende Prüfungsleistung
Zu erbringende Studienleistung
Literatur
Various materials will be provided through the ILIAS online learning tool.
Zwingende Voraussetzung

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Modulname	**Nummer**
Major module: Biomaterials and Biosystems	08LE05MO-88633086-403
Modulverantwortliche/r	
Prof. Dr. Venkatram Prasad Shastri	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	15.0
Empfohlenes Fachsemester	2
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	450h

Teilnahmevoraussetzung
For Bilingual profile: M1 “Macromolecular Materials and Chemistry” or M2 “Polymer Physics” (one of them) and the lab course in “Macromolecular Materials and Chemistry” have to be passed. For Binational profile: lab course in “Macromolecular Materials and Chemistry” have to be passed.

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Methods and Techniques in Biomaterial Science	Vorlesung	Pflicht		2.00	
MC IV Materials in Life Sciences	Vorlesung	Pflicht		2.00	90
Progress in Biomaterials Engineering	Seminar	Pflicht		3.00	
Progress in Biomaterials Engineering - excercise	Übung	Pflicht		1.00	
Aspects of Freeform Fabrication and 3D-Printing	Seminar	Wahlpflicht		2.00	
3D-Printing of Biomaterials	Praktikum	Wahlpflicht		4.00	

Qualifikationsziel
From nature inspired materials are the basis of this module. The students learn the structure of biopolymers and the get an overview about actual research and industial research.

Zu erbringende Prüfungsleistung
Methods and Techniques in Biomaterial Science: participation in lectures MC IV - Polymers for Life Sciences: graded presentation Progress in Biomaterials Engineering: graded term paper Aspects of Freeform Fabrication and 3D-Printing: graded presentation 3D-Printing of Biomaterials: graded written report overall oral examination (covering lectures "MC IV - Polymers for Life Sciences" and "Progress in Biomaterials Engineering" and "Methods and Techniques in Biomaterial Science") Final Grade: MC IV Polymers for Life Sciences: 20 % Progress in Biomaterials Engineering: 20 % Aspects of Freeform Fabrication and 3D-Printing and 3D-Printing of Biomaterials: 20 % overall oral examination: 40 %
Zielgruppe
A maximum of 15 students can be admitted for this module.

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Modulname	**Nummer**
Major module: Biomaterials and Biosystems	08LE05MO-88633086-403
Veranstaltung	
Methods and Techniques in Biomaterial Science	
Veranstaltungsart	Nummer
Vorlesung	08LE05V-ID050421
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
The lecture gives an overview of the application fields of different biomaterials (polymeric, ceramic, metallic), the specific requirements on the materials and presents in-depth information on a wide range of methods for biomaterial characterization. Among those are surface characterization methods (such as XPS and microscopy techniques), mechanical characterization, spectroscopic methods (such as IR, CD and EPR) and characterization of interactions with living systems (in vivo behavior, material cell interactions, biofilm formation).
Zu erbringende Prüfungsleistung
-
Zu erbringende Studienleistung
participation in lectures
Zwingende Voraussetzung
-

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Modulname	**Nummer**
Major module: Biomaterials and Biosystems	08LE05MO-88633086-403
Veranstaltung	
MC IV Materials in Life Sciences	
Veranstaltungsart	Nummer
Vorlesung	08LE05V-ID050013
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch
Workload	90

Inhalte
The lecture covers various aspects of modern biomaterial science: Topics are biofunctional macromolecular chemistry, system integration, imaging techniques and selected applications of functional polymers in life sciences.
Zu erbringende Prüfungsleistung
Im Rahmen der Modulteilprüfung Makromolekulare Chemie im Studiengang M.Sc. Chemie können 3 ECTS Punkte angerechnet werden. In diesem Fall werden keine weiteren ECTS Punkte als Studienleistung im Modul „Methoden und Konzepte“ angerechnet. Part of the exam of the module "Biomaterials and Biosystems" in the study program M.Sc. Sustainable Materials - Polymer Science. PL: graded presentation and graded written report
Zu erbringende Studienleistung
Für das Modul „Methoden und Konzepte" 1 ECTS: Anwesenheit; keine weiteren Studienleistungen erforderlich
Literatur
B.Tieke, “Makromolekulare Chemie- Eine Einführung”, Wiley-VCH, Weinheim 2005 Handouts und Übungsmaterial zum Modul in den jeweiligen Lehrveranstaltungen und weiterführende Informationen zu den Modulen unter http://portal.uni-freiburg.de/makro-chemie
Zwingende Voraussetzung
-

↑

Modulname	**Nummer**
Major module: Biomaterials and Biosystems	08LE05MO-88633086-403
Veranstaltung	
Progress in Biomaterials Engineering	
Veranstaltungsart	Nummer
Seminar	08LE05S-ID050031
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	3.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
This theme-driven modular class covers a wider variety of topics concerning the application of materials in biomedical applications. The topics covered include synthetic and biological polymeric systems for tissue engineering, cell encapsulation and de novo tissue repair, nanomaterials for drug delivery, imaging and diagnostics, concepts in nanoscale surface engineering, bottom-up and top-down design of nanomaterials and systems using bio-orthogonal chemistry, with an emphasis on applications in cardiovascular diseases, cancer, and stem cell niche design.
Zu erbringende Prüfungsleistung
PL: graded term paper
Zu erbringende Studienleistung
Zwingende Voraussetzung
keine

↑

Modulname	**Nummer**
Major module: Biomaterials and Biosystems	08LE05MO-88633086-403
Veranstaltung	
Progress in Biomaterials Engineering - excercise	
Veranstaltungsart	Nummer
Übung	08LE05Ü-ID050432
Fachbereich / Fakultät	

ECTS-Punkte	
Semesterwochenstunden (SWS)	1.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
The content of the lecture "Progress in Biomaterials Engineering" will be supposed by this exercise.
Zu erbringende Prüfungsleistung
-
Zu erbringende Studienleistung
attendence is obligatory.
Zwingende Voraussetzung

↑

Modulname	**Nummer**
Major module: Biomaterials and Biosystems	08LE05MO-88633086-403
Veranstaltung	
Aspects of Freeform Fabrication and 3D-Printing	
Veranstaltungsart	Nummer
Seminar	08LE05S-ID050311
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie-VB	

ECTS-Punkte	
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Wahlpflicht
Lehrsprache	englisch

Inhalte
This seminar-type class provides the theoretical basis for the practical work of labcourse e. It will cover a broad range of freeform fabrication techniques, with a focus on 3D-printing, especially of biomaterials.
Zu erbringende Prüfungsleistung
graded presentation
Zu erbringende Studienleistung
participation
Zwingende Voraussetzung
Only students of the S3 module of the master program Sustainable Materials - Polymer Science can enroll for courses
Zielgruppe
Only students of the S3 module can enroll for courses.

↑

Modulname	**Nummer**
Major module: Biomaterials and Biosystems	08LE05MO-88633086-403
Veranstaltung	
3D-Printing of Biomaterials	
Veranstaltungsart	Nummer
Praktikum	08LE05P-ID050312
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie-VB	

ECTS-Punkte	
Semesterwochenstunden (SWS)	4.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Wahlpflicht
Lehrsprache	englisch

Inhalte
In this labcourse the students will be introduced into aspects of biomaterial processing via 3D-Printing. The course will cover synthetic, analytical and processing aspects and will enable the students to get hands-on experience with this increasingly important processing technique in the fields of (bio)medicine and material science.
Zu erbringende Prüfungsleistung
PL: graded report
Zu erbringende Studienleistung
SL: participation in lab
Zwingende Voraussetzung
Only students of the S3 module of the master program Sustainable Materials - Polymer Science can enroll for courses
Zielgruppe
Only students of the S3 module can enroll for courses.

↑

Modulname	**Nummer**
Major module: Biobased Materials	08LE05MO-88633086-404
Modulverantwortliche/r	
Prof. Dr. Andreas Walther	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	15.0
Empfohlenes Fachsemester	
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	450h

Teilnahmevoraussetzung
For Bilingual profile: M1 “Macromolecular Materials and Chemistry” or M2 “Polymer Physics” (one of them) and the lab course in “Macromolecular Materials and Chemistry” have to be passed. For Binational profile: lab course in “Macromolecular Materials and Chemistry” have to be passed.

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
MC V Soft Matter and Bio Nanosciences	Vorlesung	Pflicht		2.00	
Physical and Mechanical Behavior of Wood	Lehrveranstaltung	Pflicht	5.0		150 h
Bio-based Polymers	Lehrveranstaltung	Pflicht	5.0		150 h
Bioinspirierte Funktionsmaterialien / Bioinspired functional materials - Vorlesung	Vorlesung	Pflicht	3.0	2.00	90 Stunden

Qualifikationsziel
The students know the most important technologies and methods of renewable resources and do have solid knowledge in the field of synthesis and production of novel biobased materials including starting compounds and intermediates.
Zusammensetzung der Modulnote
PL: oral exam on the contents of the lectures "MC V" and "Bioinspired functional materials" (40 %) and grades from courses "Physical and Mechanical Behavior of Wood" and "Bio-based Polymers" (each course 30 %) compensation is possible

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Modulname	**Nummer**
Major module: Biobased Materials	08LE05MO-88633086-404
Veranstaltung	
MC V Soft Matter and Bio Nanosciences	
Veranstaltungsart	Nummer
Vorlesung	08LE05V-ID050427
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie-VB	

ECTS-Punkte	
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	deutsch

Inhalte
This course will connect self-assembly and other structuration processes to the materials world with a special emphasis on soft matter and biobased/biological components: Self-assembly vs. self-organization; switches vs. motors; responsive vs active materials; hierarchical force and time scales; surface forces and wetting; liquid crystalline polymers; reversible polymers and self-healing; biobased macromolecular systems (peptide, proteins, DNA Nanoscicence); topology effects of macromolecular systems.
Zu erbringende Prüfungsleistung
Im Rahmen der Modulteilprüfung Makromolekulare Chemie im Studiengang M.Sc. Chemie können 3 ECTS Punkte angerechnet werden. In diesem Fall werden keine weiteren ECTS Punkte als Studienleistung im Modul „Methoden und Konzepte“ angerechnet. Part of the Exam "Advanced Macromolcular Materials and Nanostructural Engineering" of the study program M.Sc. Sustainable Materials - Polymer Science.
Zu erbringende Studienleistung
for methods and concepts: 1 ECTS attendance
Zwingende Voraussetzung
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Modulname	**Nummer**
Major module: Biobased Materials	08LE05MO-88633086-404
Veranstaltung	
Physical and Mechanical Behavior of Wood	
Veranstaltungsart	Nummer
Lehrveranstaltung	10LE07V-M.55155
Fachbereich / Fakultät	
Fakultät für Umwelt und Natürliche Ressourcen Institut für Geo- und Umweltnaturwissenschaften, Professur für Forstliche Biomaterialien-VB	

ECTS-Punkte	5.0
Semesterwochenstunden (SWS)	
Empfohlenes Fachsemester	
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch
Präsenzstudium	70 h
Selbststudium	80 h
Workload	150 h

Inhalte
Wood is a natural material of large industrial significance. Its unique structure, composition and design confer specific physical and mechanical properties, which largely impact processing and utilization both as a solid material and in derived bio-based composites. Within this context, this module aims at understanding the physical, viscoelastic and mechanical properties of wood in light of its structural features. It comprises 3 sections: 1) wood physics, 2) wood viscoelasticity and mechanics, and 3) laboratory methods for the characterization of solid wood properties. In the first section, the physical behavior of wood will be considered by defining the main materials attributes and by delineating wood-water relationships. In addition, wood modification approaches aimed at the stabilization of wood will be presented. The second section will present the basic principles for understanding the mechanical and viscoelastic behavior of wood. The different modes and approaches to evaluate the viscoelastic and mechanical performance of solid wood in static and dynamic conditions and other relevant performance criteria such as fracture toughness will be reviewed. The last section will provide both theoretical background and hands-on experience to characterize the physical, mechanical and viscoelastic properties via a laboratory project. It will further propose a platform to delineate the relationships between the physical, viscoelastic and mechanical properties of wood.

Lernziele / Lernergebnisse
At the end of the module, students should be able to ■ Read and interpret psychometric charts (2) ■ Relate wood structure to its orthotropic and hygroscopic character (3) ■ Present and discuss wood-water relationships in light of the various states of water in wood (3) ■ Calculate and model water sorption isotherms in wood (3) ■ Compare the main mechanical properties of wood to those of other common building materials (4) ■ Illustrate and discuss the impact of wood orthotropy on its performance (3) ■ List some of the inherent advantages and disadvantages of wood in its utilization for solid wood applications (1) ■ Propose possible approaches to improve wood dimensional stability and performance (3) ■ Define the standard mechanical properties of wood and explain the principle of the measurements methods. (2) ■ Acquire and analyze laboratory data for wood density, specific gravity, moisture content, and wood mechanical and viscoelastic properties. (4) ■ Illustrate the impact of water on the physical, viscoelastic and mechanical behavior of wood. (2) Classification of cognitive skills following Bloom (1956): 1 = Knowledge: recalling facts, terms, basic concepts and answers; 2 = Comprehension: understanding something; 3 = Application: using a general concept to solve problems in a particular situation; 4 = Analysis: breaking something down into its parts; 5 = Synthesis: creating something new by putting parts of different ideas together to make a whole; 6 = Evaluation: judging the value of material or methods.
Zu erbringende Prüfungsleistung
Written exam (120 min) and presentation of laboratory results
Zu erbringende Studienleistung
Literatur
■ R., Ross, R. J., Star, N. M.; Wood Handbook – Wood as an Engineering Material; Forest Products Laboratory, Madison, WI; 2010; http://www.fpl.fs.fed.us/products/publications/several_pubs.php?grouping_id=100&header_id=p ■ Wood: Influence of Moisture on Physical Properties, J. F. Siau, ISSBN No: 0-9622181-0-3 ■ Skaar C. Wood-Water Relationship. Springer Verlag Press
Zwingende Voraussetzung
Empfohlene Voraussetzung
Previous modules of „Biomaterials and Bioenergy“
Lehrmethoden
Lectures, self-study, laboratory
Zielgruppe
M.Sc. Environmental Scienes, Elective Track "Biomaterials and Bioenergy"

↑

Modulname	**Nummer**
Major module: Biobased Materials	08LE05MO-88633086-404
Veranstaltung	
Bio-based Polymers	
Veranstaltungsart	Nummer
Lehrveranstaltung	10LE07V-M.55145
Fachbereich / Fakultät	
Fakultät für Umwelt und Natürliche Ressourcen Institut für Geo- und Umweltnaturwissenschaften, Professur für Forstliche Biomaterialien-VB	

ECTS-Punkte	5.0
Semesterwochenstunden (SWS)	
Empfohlenes Fachsemester	
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch
Präsenzstudium	ca. 70h
Selbststudium	ca. 80h
Workload	150 h

Inhalte
Bio-based polymers are at least partly derived from renewable natural sources and comprise i) bio-based polymers directly derived from vegetal biomass, ii) classically synthesized from bio-based monomers and iii) produced directly by micro-organisms. Bio-based polymers provide an alternative to petroleum-based polymers and are also often designed for biodegradability or compostability. This module surveys in four sections, the production, structure and properties of a wide range of bio-based polymers of current industrial relevance. In the first section the fundamental concepts of polymers are introduced. Polymer parameters, polymer types and concepts of biodegradability and compostability are presented. The chemistry and properties of industrially-relevant bio-based polymers derived from biomass are then discussed in a second section. This includes the first (bio)plastic materials ever produced and still of major industrial relevance viz. cellulose derivatives, but also polymers based on starch, plant oil, lignin / furans etc. The following section tackles bio-based polymers produced from bio-based monomers and microorganisms. This section encompasses a majority of polyesters such as polylactic acid (PLA) and polyhydroxyalkanoates (PHB). In contrast to bio-based polymers, examples of petroleum-derived polymers particularly designed for biodegradability or compostability are also introduced there. In presenting these families of bio-based polymers, emphasis is placed on the chemistry of production, structure-property relationships and the resulting application. The module concludes with a bio-based polymer laboratory, where students characterize industrial samples of petroleum and bio-based adhesives and design the process for their utilization in natural fibre composites. Adhesives and composites will be characterized with common analytical methods in order to establish structure-property relationships. Excursions will further help appreciate the industrial interest, production processes and challenges associated with bio-based polymers.

Lernziele / Lernergebnisse
At the end of the module, students should be able to ■ Define and highlight the difference between the concepts “bio-based”,” biodegradable” and ”compostable” (2) ■ Define the 5 polymer parameters and illustrate with concrete examples of polymers. (2, 3) ■ Describe the production pathway, chemistry and main properties of the major bio-based polymers of industrial relevance. (2) ■ Appraise the major properties of bio-based polymers based on their structure. (3) ■ Describe the principle of the main analytical tools available for R&D activities for the development and characterization of bio-based polymers (2) ■ Analyze with simple analytical techniques important structural features and thermal properties of polymers (4) ■ Formulate, manufacture, characterize and grade Natural Fiber Composites using bio-based thermosetting adhesives (4) Classification of cognitive skills following Bloom (1956): 1 = Knowledge: recalling facts, terms, basic concepts and answers; 2 = Comprehension: understanding something; 3 = Application: using a general concept to solve problems in a particular situation; 4 = Analysis: breaking something down into its parts; 5 = Synthesis: creating something new by putting parts of different ideas together to make a whole; 6 = Evaluation: judging the value of material or methods.
Zu erbringende Prüfungsleistung
Written exam (120 min) and presentation of laboratory results
Zu erbringende Studienleistung
Literatur
■ Handbook of Engineering Biopolymers, Homopolymers, Blends and Composites, Ed. S. Fakirov and D. Bhattacharyya, Hanser, Munich, 2007, ISBN-978-1-56990-405-3 ■ Handbook of Biodegradable Polymers, ed. Catia Bastioli, Rapra Technology, Shawbury, UK, 2005 ■ The Chemistry of Bio-based Polymers, J K Fink, John Wiley & Sons, Verlag, Feb 2014 ■ Natural Fibers, Biopolymers, and Biocomposites, Ed. A. Mohanty, M. Misra and L. Drzal, CRC Taylor and Francis, Boca Raton, FL, 2005, ISBN 0-8493-1741-X ■ Monomers, Polymers and Composites from Renewable Resources, Ed. M. N. Belgacem and A. Gandini, Amsterdam, 2008, Elsevier, ISBN 978-0-08-045316-3 ■ Nanocomposites with Biodegradable Polymers, Synthesis, Properties and Future Perspectives, Ed. V. Mittal, Oxford University Press, New York, 2011, ISBN 978-0-19-958192-4 ■ Biopolymers- New Materials for Sustainable Films and Coatings, Ed. D. Plackett, 2011, Noida, Wiley & sons, ISBN 9780470683415
Zwingende Voraussetzung
Empfohlene Voraussetzung
Previous modules of „Biomaterials and Bioenergy“
Lehrmethoden
Lectures, self-study, laboratory, excursion
Zielgruppe
M.Sc. Environmental Scienes, Elective Track "Biomaterials and Bioenergy"

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Modulname	**Nummer**
Major module: Biobased Materials	08LE05MO-88633086-404
Veranstaltung	
Bioinspirierte Funktionsmaterialien / Bioinspired functional materials - Vorlesung	
Veranstaltungsart	Nummer
Vorlesung	11LE50V-5125
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie Technische Fakultät	

ECTS-Punkte	3.0
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	deutsch oder englisch
Präsenzstudium	28 Stunden
Workload	90 Stunden

Inhalte
- Organic-based biological materials. Hierarchical structure and functionality - Mineralized biological materials. Hierarchical structure and functionality - Advanced methods to characterize the microstructure and properties of biological and bioinspired materials (Materials physical-chemistry and materials physics: mechanical testing; scattering techniques SAXS and WAXS for microstructure characterization; spectroscopic techniques for chemical structure characterization). Establishment of structure-properties relationship in biomaterials - Examples of preparation methods of bioinspired materials. Processing physical-chemistry and optimization - Interrelation between processing, structure and properties in bioinspired materials - Examples of bioinspired materials for technological and biomedical applications
Qualifikationsziel
In this lecture the students will get fundamental knowledge on the structure and functionality of biological materials as to apply their design principle in the development of bioinspired biomaterials. At the end of the module, the student should be able to describe the interrelation between microstructure and properties in biological materials; apply advance methods for the characterization of microstructure and properties of biological and artificially developed bioinspired materials, and explain the theoretical principle of these methods; and describe the physical-chemistry of the processing of different bioinspired materials studied in the course.
Zu erbringende Prüfungsleistung
Part of the Exam "Advanced Macromolcular Materials and Nanostructural Engineering" of the study program M.Sc. Sustainable Materials - Polymer Science. Schriftliche oder mündliche Abschlussprüfung
Zu erbringende Studienleistung

Literatur
- Materials Design Inspired by Nature. Function through Inner Architecture. Edited by: P. Fratzl, J. WC Dunlop and R. Weinkamer. RSC Publishing (2013) - Nature‘s hierarchical materials P. Fratzl and R. Weinkamer Progress in Materials Science , Volume 52, pages 1263-1334, (2007) - Bioinspiration and biomimetics. Learning from Nature. Edited by: P. Fratzl, T. Speck and S. Gorb. IOP Publishing (2016) Besides, it will be provided an script accompanying each lecture, which will be updated with recent literature.
Zwingende Voraussetzung

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Modulname	**Nummer**
Language Course II	08LE05MO-88633085_2LK
Modulverantwortliche/r	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	2.0
Empfohlenes Fachsemester	
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	60 h
Angebotsfrequenz	nur im Sommersemester

Teilnahmevoraussetzung
-

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload

Qualifikationsziel
They aim at building student proficiency in all four language skills - listening, speaking, reading, writing - and practising grammar.
Zu erbringende Studienleistung
SL: certification about the level

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Modulname	**Nummer**
Intercultural Competences	08LE05MO-88633085_2IK
Modulverantwortliche/r	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	4.0
Empfohlenes Fachsemester	
Moduldauer	2 Semster
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	120 h
Angebotsfrequenz	in jedem Semester

Teilnahmevoraussetzung
-

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Intercultural seminar in the french-german master degree program "Sustainable Materials - Polymer Science" and "Biochemistry and Biophysics"	Seminar	Pflicht	4.0		

Qualifikationsziel
See lecture: Intercultural seminar in the french-german master degree program "Sustainable Materials - Polymer Science" and "Biochemistry and Biophysics"

↑

Modulname	**Nummer**
Intercultural Competences	08LE05MO-88633085_2IK
Veranstaltung	
Intercultural seminar in the french-german master degree program "Sustainable Materials - Polymer Science" and "Biochemistry and Biophysics"	
Veranstaltungsart	Nummer
Seminar	08LE05S-ID090313
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	4.0
Semesterwochenstunden (SWS)	
Empfohlenes Fachsemester	2
Angebotsfrequenz	in jedem Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
The students acquire subject-specific and methodological, social and personal key competences that enable them to work without problems in a cross-border environment. These acquired skills go beyond pure knowledge and include a corresponding know-how and concept of life. The subject-specific competences should therefore be supplemented by cross-sectional competencies, which include the changing environment and the specificities of the border region. Three levels are addressed: · Self-knowledge (identity, way of thinking, cultural imprint) · Getting to know each other and their culture · Understand the interaction at different levels
Qualifikationsziel
At the end of the course, students should able to understand and recognize intercultural processes, become aware of the emotional mechanisms involved in the intercultural and cross-border context in order to act accordingly.
Zu erbringende Prüfungsleistung
-
Zu erbringende Studienleistung
100% attendance. Any absence must be justified and additional work might be demanded from the absentee. -Active participation in class. All participants must actively engage in all classroom activities and debates. -Class presentation. This might be a group/individual This criteria counts as follows Attendance - 20% Participation - 50% Presentation - 30%
Zwingende Voraussetzung
-

Bemerkung / Empfehlung
Conditions: The attendance in the courses is obligatory. If you are ill, please bring us a medical certificate or if there are other important reasons please inform us in advance. In addition of the attendance the teacher will explain you in the first session which kind of performance you will have to deliver to get at the end the four creditpoints.

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Modulname	**Nummer**
Vertiefungspraktikum / Advanced lab course	08LE05MO-633085-800
Modulverantwortliche/r	
Prof. Dr. Andreas Walther	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	
Empfohlenes Fachsemester	
Moduldauer	1 semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	
Angebotsfrequenz	in jedem Semester

Teilnahmevoraussetzung
The lab course in Macromolecular Materials and Chemistry has to be passed and the major module (S1, S2, S3 or S4) has to be completed.

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Advanced lab course	Prüfung	Pflicht			

Inhalte
Complex facts and issues are imparted based on the knowledge obtained in the previous courses. The students are introduced to sophisticated applications of scientific methods, which are adapted to state-of-the-art research. A solid basis for independent scientific working is created, preparing the students for the upcoming research training laboratory and the master thesis.
Qualifikationsziel
During the master laboratory course, the students learn how to work independently, using scientific methods in order to obtain information that is relevant for research. In consultation with the responsible person, the course may take place in industry or at a different university or research facility.
Zu erbringende Prüfungsleistung
PL: Report, presentation or oral exam (in consultation with the supervisor of the master thesis)
Zu erbringende Studienleistung
working time in a lab: 270h (9 ECTS-Points), 360h (12 ECTS-Points) or 540h (18 ECTS-Points)
Bemerkung / Empfehlung
This module could count 9 ECTS-Points, 12 ECTS-Points or 18 ECTS-Points.

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Modulname	**Modulnummer**
Sustainable Materials - Polymer Sciences, binationale Variante, M.Sc., PO 2017	08LE05MO-633085-800
Name der Prüfungsleistung	
Advanced lab course	
Leistungsart	Nummer
Prüfung	08LE05PL-633085-800
Verantwortliche/r	
Fachbereich / Fakultät	

Prüfungsform	nicht festgelegt
Benotung	D-Noten (ganze um 0,3 verä)
Teilnahmepflicht	Pflicht
Prüfungssprache	deutsch

↑

Modulname	**Nummer**
Advanced Polymers	08LE05MO-88633085_300
Modulverantwortliche/r	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	
Empfohlenes Fachsemester	
Moduldauer	
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	

Teilnahmevoraussetzung

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Advanced Polymers	Prüfung	Pflicht			

Qualifikationsziel

↑

Modulname	**Modulnummer**
Sustainable Materials - Polymer Sciences, binationale Variante, M.Sc., PO 2017	08LE05MO-88633085_300
Name der Prüfungsleistung	
Advanced Polymers	
Leistungsart	Nummer
Prüfung	08LE05PL-88633085_300
Verantwortliche/r	
Fachbereich / Fakultät	

Prüfungsform	nicht festgelegt
Benotung	D-Noten (ganze um 0,3 verä)
Teilnahmepflicht	Pflicht
Prüfungssprache	deutsch

↑

Name des Kontos	**Nummer des Kontos**
Industrial Polymer Sciences	08LE05KT-IPS
Verantwortliche/r	
Prof. Dr. Andreas Walther	
Fachbereich / Fakultät	

Pflicht/Wahlpflicht (P/WP)	Pflicht
ECTS-Punkte	9,0
Benotung	A- Berechnung 1 NachK
Empfohlenes Fachsemester	2

Kommentar
This module will give some introduction in industrial chemical work. In this Module - you have tree parts: ■ Exkursion ■ Methods for application ■ Polymers in membrane technolgy

↑

Modulname	**Nummer**
Modul Industrial Polymer Sciences: Exkursion	08LE05MO-ID050033
Modulverantwortliche/r	
Prof. Dr. Andreas Walther	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	5.0
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	60 h
Angebotsfrequenz	nur im Sommersemester

Teilnahmevoraussetzung
-

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Industrial Polymer Sciences	Exkursion	Pflicht			
Industrial Polymer Sciences: Excursion	Studienleistung	Pflicht	5.0		

Qualifikationsziel
Bemerkung / Empfehlung
Please have a look to the "Veranstaltung" Industrial Polymer Sciences: Exkursion

↑

Modulname	**Nummer**
Modul Industrial Polymer Sciences: Exkursion	08LE05MO-ID050033
Veranstaltung	
Industrial Polymer Sciences	
Veranstaltungsart	Nummer
Exkursion	08LE05E-ID050033
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
Courses by a lecturer from the industrial companies. Excursion visiting industrial mass productions, preparing a visit report.
Zu erbringende Prüfungsleistung
-
Zu erbringende Studienleistung
SL: participation in lectures and excursions
Zwingende Voraussetzung
-

↑

Modulname	**Modulnummer**
Industrial Polymer Sciences	08LE05MO-ID050033
Name der Studienleistung	
Industrial Polymer Sciences: Excursion	
Leistungsart	Nummer
Studienleistung	08LE05SL-ID050033
Verantwortliche/r	
Fachbereich / Fakultät	

Prüfungsform	nicht festgelegt
ECTS	5.0
Benotung	
Teilnahmepflicht	Pflicht
Prüfungssprache	deutsch

↑

Modulname	**Nummer**
Modul Industrial Polymer Sciences: Methods for application	08LE05MO-ID050037
Modulverantwortliche/r	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	2.0
Semesterwochenstunden (SWS)	3.0
Empfohlenes Fachsemester	2
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	90 h
Angebotsfrequenz	nur im Sommersemester

Teilnahmevoraussetzung
-

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Methods for Applications of Polymers in Life Sciences	Praktikum	Pflicht			
Industrial Polymer Sciences: Methods for applications of polymers in life sciences	Studienleistung	Pflicht	2.0		

Qualifikationsziel
Bemerkung / Empfehlung
Please have a look to the "Veranstaltung" Industrial Polymer Sciences: Methods for application

↑

Modulname	**Nummer**
Modul Industrial Polymer Sciences: Methods for application	08LE05MO-ID050037
Veranstaltung	
Methods for Applications of Polymers in Life Sciences	
Veranstaltungsart	Nummer
Praktikum	08LE05P-ID050037
Fachbereich / Fakultät	
Institut für Makromolekulare Chemie	

ECTS-Punkte	
Semesterwochenstunden (SWS)	
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch

Inhalte
The implementation of materials in life sciences requires a multidisciplinary skill set. This series of lab modules will cover the synthesis, characterization and application of synthetic and natural biodegradable polymers for drug delivery, cell delivery and cell targeted therapies. The participants will be exposed to specific analytical techniques and characterization methods such as dynamic light scattering, atomic force microscopy, scanning electron microscopy, cell culture, fluorescent and light microscopy and rheology, that are critical for biomaterials research.
Zu erbringende Prüfungsleistung
-
Zu erbringende Studienleistung
participation and ungraded report.
Zwingende Voraussetzung

↑

Modulname	**Modulnummer**
Industrial Polymer Sciences	08LE05MO-ID050037
Name der Studienleistung	
Industrial Polymer Sciences: Methods for applications of polymers in life sciences	
Leistungsart	Nummer
Studienleistung	08LE05SL-ID050037
Verantwortliche/r	
Fachbereich / Fakultät	

Prüfungsform	nicht festgelegt
ECTS	2.0
Benotung	
Teilnahmepflicht	Pflicht
Prüfungssprache	deutsch

↑

Modulname	**Nummer**
Modul Industrial Polymer Sciences: Polymers in membrane technolgy	08LE05MO-5114
Modulverantwortliche/r	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	2.0
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	90 h
Angebotsfrequenz	nur im Sommersemester

Teilnahmevoraussetzung

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Polymere in der Membrantechnik / Polymers in Membrane Technology - Vorlesung	Vorlesung	Pflicht	3.0	2.00	90 Stunden
Industrial Polymer Sciences: Polymers in membrane technolgy	Studienleistung	Pflicht	2.0		

Qualifikationsziel
Bemerkung / Empfehlung
Please have a look to the "Veranstaltung" Industrial Polymer Sciences: Polymers in membrane technolgy

↑

Modulname	**Nummer**
Modul Industrial Polymer Sciences: Polymers in membrane technolgy	08LE05MO-5114
Veranstaltung	
Polymere in der Membrantechnik / Polymers in Membrane Technology - Vorlesung	
Veranstaltungsart	Nummer
Vorlesung	11LE50V-5114
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie Technische Fakultät	

ECTS-Punkte	3.0
Semesterwochenstunden (SWS)	2.0
Empfohlenes Fachsemester	2
Angebotsfrequenz	nur im Sommersemester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Lehrsprache	englisch
Workload	90 Stunden

Inhalte
The lecture will focus on polymeric materials for membrane separation technologies. The scope of applications that will be discussed ranges from water to oil & gas, biotech, dialysis to food with a focus on water filtration technologies. Creating awareness for major societal challenges like clean water supply, health care / quality of life and minimization of energy consumption and for contributions that membrane technologies can offer to sustainable solutions for these challenges will be key learning objectives. Focus will be on materials and membrane fabrication / post-modification processes as well as on the underlying principles of separation. Process engineering will be of minor importance. The lecture will concentrate on cognitive levels ‘understanding’ and ‘application’ (Bloom’s taxonomy), case studies will touch upon higher levels.
Zu erbringende Prüfungsleistung
-Schriftliche oder mündliche Prüfungsleistung
Zu erbringende Studienleistung
in the study program Sustaianble Materials - Polymer Science: participation and ungraded report
Literatur
Various materials are available on the website Homepage: http://www.imtek.de/cpi
Zwingende Voraussetzung
-

↑

Modulname	**Modulnummer**
Industrial Polymer Sciences	08LE05MO-5114
Name der Studienleistung	
Industrial Polymer Sciences: Polymers in membrane technolgy	
Leistungsart	Nummer
Studienleistung	11LE50SL-5114
Verantwortliche/r	
Fachbereich / Fakultät	

Prüfungsform	nicht festgelegt
ECTS	2.0
Benotung	
Teilnahmepflicht	Pflicht
Prüfungssprache	deutsch

↑

Modulname	**Nummer**
Language Course III	08LE05MO-88633085_3LK
Modulverantwortliche/r	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	3.0
Empfohlenes Fachsemester	
Moduldauer	1 semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	90 h
Angebotsfrequenz	nur im Wintersemester

Teilnahmevoraussetzung
-

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload
Language Course III	Studienleistung	Pflicht	3.0		

Qualifikationsziel
They aim at building student proficiency in all four language skills - listening, speaking, reading, writing - and practising grammar.
Zu erbringende Studienleistung
SL: certification about the level

↑

Modulname	**Modulnummer**
Sustainable Materials - Polymer Sciences, binationale Variante, M.Sc., PO 2017	08LE05MO-88633085_3LK
Name der Studienleistung	
Language Course III	
Leistungsart	Nummer
Studienleistung	08LE05SL-880633085langua-ge3-FS
Verantwortliche/r	
Fachbereich / Fakultät	

Prüfungsform	nicht festgelegt
ECTS	3.0
Benotung	
Teilnahmepflicht	Pflicht
Prüfungssprache	deutsch

↑

Modulname	**Nummer**
Master Module / Mastermodul	08LE05MO_88633085_8000
Modulverantwortliche/r	
Prof. Dr. Andreas Walther	
Fachbereich / Fakultät	
Fakultät für Chemie und Pharmazie	

ECTS-Punkte	30.0
Empfohlenes Fachsemester	4
Moduldauer	1 Semester
Pflicht/Wahlpflicht (P/WP)	Pflicht
Workload	

Teilnahmevoraussetzung
The lab course in Macromolecular Materials and Chemistry has to be completed. A minimum of 70 ECTS Credit Points has to be accumulated before.

Zugehörige Veranstaltungen					
Name	Art	P/WP	ECTS	SWS	Workload

Inhalte
The master thesis is a scientific project, in which the candidate is guided concerning topic, content and methods. It is connected to a particular field of research and it is supposed to be kept simple. The thesis is guided by two supervisors. One of them must be Professor at the University of Freiburg or Strasbourg (“Referent”). The master thesis is supposed to be done at the faculty of chemistry and pharmacy, the faculty of engineering, the faculty of environment and natural resources, the faculty of mathematics and physics or at the University of Strasbourg. Exceptions to this rule must be approved by the examination committee (“Masterprüfungsausschuss”).
Qualifikationsziel
The students learn how to read, question, understand and write scientific articles. In the end, they are capable of applying their expert knowledge in a new, unfamiliar and multidisciplinary context. They are able to apply modern techniques and to plan, execute and document experiments independently.
Zu erbringende Prüfungsleistung
PL: written master thesis (English or German).
Zu erbringende Studienleistung
Every thesis has to be defend in the working group of the supervisor

↑

Epilog

Freiburg

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79085 Freiburg - Germany

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